

MULTIMEDIA



UNIVERSITY

STUDENT ID NO

--	--	--	--	--	--	--	--	--	--

MULTIMEDIA UNIVERSITY

FINAL EXAMINATION

TRIMESTER 1, 2016/2017

PCM0035 – GENERAL CHEMISTRY
(All sections / Groups)

21 OCTOBER 2016
3.00 p.m. – 5.00 p.m.
(2 Hours)

INSTRUCTIONS TO STUDENT

1. This question paper consists of 4 pages only excluding the cover page.
2. Attempt **ALL** questions. Distribution of the marks for each question is given.
3. Please write all your answers in the Answer booklet provided.

QUESTION 1 [20 MARKS]

- (a) Provide the feature of an orbital that related to Magnetic Quantum Number (m_l).
[1 mark]
- (b) List all the possible values of n , l , m_l and m_s for electrons in the 3p subshell.
[2.5 marks]
- (c) Indicate the number of unpaired electrons present in the following atoms:
(i) Potassium (atomic number: 19) [1 mark]
(ii) Phosphorus (atomic number: 15) [1 mark]
- (d) The atomic number of Chlorine is 17.
(i) Write its ground-state electron configuration, without using a noble gas core. [1 mark]
(ii) Write a balanced chemical reaction equation for its reaction with hydrogen. [1 mark]
- (e) A change in size is detected when a neutral atom is converted to an cation. Which one is smaller, neutral atom or cation? Discuss your answer.
[2.5 marks]
- (f) The poisonous gas hydrogen cyanide has a chemical formula of HCN.
(i) State the total number of valence electrons in HCN [0.5 mark]
(ii) Draw the *Lewis structure* for HCN [1.5 marks]
(iii) How many lone pair electron does HCN has? [0.5 mark]
(iv) Does the *Lewis structure* of HCN obey the octet rule? If no, please state the exception category.
[0.5 mark]
- (g) Name the shape (molecular geometry) and give the AB_mE_n classification for the following compounds:
(i) ClO_3^- [2 marks]
(ii) NO_3^- [2 marks]

Continued...

- (h) For the following compound in **Figure 1**:

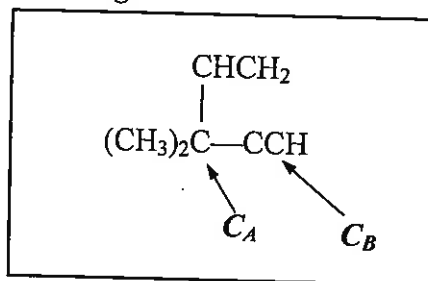


Figure 1

- (i) Predict the correct hybridization for the carbon atoms, C_A and C_B , indicated in the molecule shown in **Figure 1** above. [2 marks]
- (ii) Determine the number of sigma (σ) bonds and pi (π) bonds in the molecule. [1 mark]

QUESTION 2 [15 MARKS]

- (a)

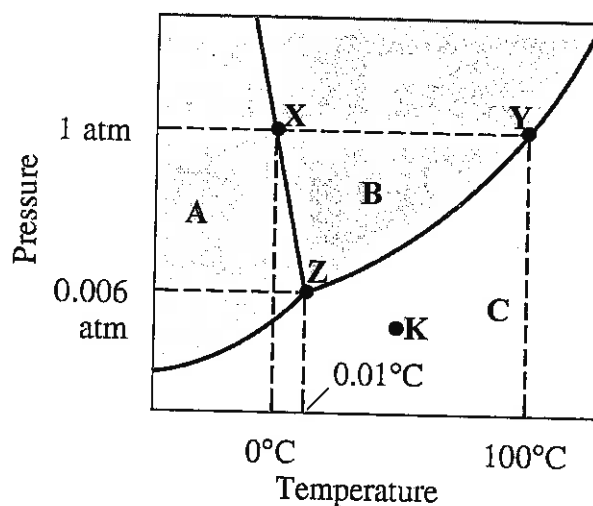


Figure 2

Figure 2 shows the phase diagram of water.

- (i) Label all the regions A, B, C and points X, Y, Z. [3 marks]
- (ii) Predict the phase changes of water and the name of the process as a result of the following changes:
Starting at point K, lower its temperature at constant pressure. [1.5 marks]

Continued...

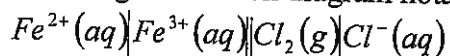
- (b) (i) State the property of water that enabled some small insects to walk on its surface. [0.5 mark]
- (ii) Briefly discuss the effect of temperature on the viscosity of a fluid. [1 mark]
- (c) Which substance has the higher boiling point? Explain your answer.
- (i) CH_3CH_3 and CH_3OH . [1.5 marks]
- (ii) $\text{HOCH}_2\text{CH}_2\text{OH}$ and $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$ [1.5 marks]
- (d) Below reaction is given.
- $$\text{A} + \text{B} + \text{C}_2 \longrightarrow \text{AC} + \text{BC}$$
- Experimental results showed that:
- Reaction rate doubles when the concentration of C_2 is doubled.
 - Reaction rate triples when the concentration of A is tripled.
 - Reaction rate remained the same when the concentration of B is doubled.
- (i) Find the rate law for this reaction. Explain briefly. [2 marks]
- (ii) Find the overall reaction order. [0.5 mark]
- (e) Below reaction is a first order reaction.
- $$\text{XY} \longrightarrow \text{X} + \text{Y}$$
- The *half-life* of the reaction is 45 seconds.
- (i) Define *half-life*. [0.5 mark]
- (ii) Find the first-order rate constant for this reaction. [1 mark]
- (ii) Find the time required for 90 percent of XY to decompose. [2 marks]

QUESTION 3 [15 MARKS]

- (a) (i) Calculate the pH of $3.7 \times 10^{-4} \text{ M KOH}$. [1 mark]
- (ii) Calculate the concentration of OH^- ions in 0.8 M HNO_3 solution. [1 mark]
- (b) (i) Give the **Brønsted-Lowry** definition of acids and bases. [1 mark]
- (ii) Write the conjugate base formula of HClO_3 . [1 mark]
- (c) Rank the following acids in the order of increasing acid strength (weakest first):
- $$\text{HCl} \quad \text{HI} \quad \text{HBr} \quad \text{HF}$$
- [1.5 marks]
- (d) Based on their molecular structure, select which of the following acid is stronger and give reason: HClO_3 HBrO_3 [1.5 marks]

Continued...

- (e) Given the following voltaic cell diagram notation:



- (i) Write the half-reaction equation at cathode. [1 mark]
 - (ii) Write the balanced overall cell reaction. [1 mark]
 - (iii) Determine the oxidizing agent of the cell reaction. [0.5 mark]
 - (iv) Which species is being oxidized? [0.5 mark]
- (f) In one experiment, a cell depositing Cu from Cu^{2+} bath operated for 10 hours with an average current of 5.8 A.
(Faraday Constant: 96500 C/mol e^{-} ; Atomic mass Cu = 63.55)
- (i) Write the half-reaction equation. [1 mark]
 - (ii) How many coulombs of electric charge were used? [1.5 marks]
 - (iii) How many grams of copper (Cu) deposited within this 10 hours? [1.5 marks]
 - (iv) Like any piece of apparatus, an electrolytic cell operates at less than 100% efficiency. If 53.4 g of copper is deposited, at what efficiency is the cell operating? [1 mark]

End of Paper